Proposal Form For Addition And Revision Of Courses

1. Proposing College / School: Samuel Ginn College of Engineering
   Department: Chemical Engineering

2. Course Prefix and Number: CHEN 5660 3. Effective Term: Fall 2010

4. Course Title: Macroscale Assembly & Applications of Nanomaterials
   Abbreviated Title (30 characters or less): Macro Assembly & Apps Nanomtls

5. Requested Action:
   - [ ] Renumber a Course
   - [ ] Add a Course
   - [ ] Revise a Course
   - [ ] Current Course Number: [ ]
   - [ ] Proposed Course Number: [ ]

6. Course Credit:
<table>
<thead>
<tr>
<th>Contact/Group Hours</th>
<th>Scheduled Type (e.g.: Lab, Lecture, Practicum, Directed Study)</th>
<th>Weekly or Per Term?</th>
<th>Credit Hours</th>
<th>Anticipated Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Hours</td>
<td>3 Lecture</td>
<td>Weekly</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>(Repeatability):</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7. Grading Type: [ ] Regular (ABCDF) [ ] Satisfactory/Unsatisfactory (S/U) [ ] Audit

8. Prerequisites/Corequisites:
   P - (Senior Standing in Engineering or Science) OR (Junior Standing in Engineering or Science with Instructor Approval)

9. Restrictions: List specific restriction in space above. [ ] College [ ] Major [ ] Standing [ ] Degree

10. Course Description:
    Production of macroscopic assemblies and structures from nanomaterials. Processing and applications of inorganic, organic, biological and hybrid nanomaterials.

11. May Count Either Program Type or Program Title (Indicate if this particular course cannot be counted for credit in addition to another)
    - [ ] (e.g.: minor, major, etc.)
    - [ ] (e.g.: MS in Chemistry, Performance Option, Minor in Art) (required or optional?)

12. Affected Program(s):
    (Respond “N/A” if not included in any program; attach memorandum if more space is required)
    | Program Type | Program Title | Requirement or Elective? |
    |--------------|---------------|--------------------------|
    | Major        | BS in Chemical Engineering | Elective |

13. Overlapping or Duplication of Other Units’ Offerings:
    (If course is included in any other degree program, is used as an elective frequently by other unit(s), or is in an area similar to that covered by another college/school, attach correspondence with relevant unit)
    [ ] Applicable
    [ ] Not Applicable
14. Justification: This course supports the growing importance of nanomaterial processing and applications in Chemical Engineering. Several departmental faculty are conducting research in this topic area.

(Include a concise, yet adequate rationale for the addition/revision of the course, citing accreditation, assessments (faculty, graduate, and/or external) where applicable)

15. Resources: No additional resources are required. The course has been offered several times as a Special Topic.

(Indicate whether existing resources such as library materials, classroom/laboratory space, and faculty appointments are adequate to support the proposed addition/revision; if additional resources are required, indicate how such needs will be met, referencing the appropriate level of authorization -- i.e.: Dean -- where necessary; if no additional resources or shifting of resources will be necessary, respond “Not Applicable”)

16. Student Learning Outcomes:

1. Connect fundamental scientific and engineering principles and processes with the development of useful nanomaterial enhanced macroscopic materials and structures.
2. Understand the influence of nanomaterial size and shape on measurable properties.
3. Name key categories of nanomaterials and describe their potential applications.
4. Name current and emerging applications for key categories of nanomaterials.
5. Describe key methods for characterizing nanomaterials and macroscale assemblies of nanomaterials (e.g. electrical conductivity, mechanical strength, spectroscopic signatures, multi-scale microscopy).
6. Discuss the potential health, safety, environmental and societal implications of commercialization of nanomaterials.
7. Critically evaluate orally and in writing recent scientific literature and mass media stories related to macroscale assemblies of nanomaterials (e.g. space elevator, solar panels, sporting goods, cancer detection and treatment).
8. Qualitatively describe the importance and meaning of nanomaterial dispersion and the thermodynamic and physical forces that govern dispersion. (Graduate students will also do some quantification).
9. Name the key types of liquid crystals, understand the fundamental driving forces for liquid crystalline phase behavior, and describe the applicability of liquid crystalline science to rigid 1-dimensional nanomaterials.
10. Describe the pros and cons and scalability of solid, liquid and melt phase processing routes.
11. Explain the goals and challenges associated with nanocomposite engineering and describe routes being investigated for overcoming these challenges.

(State in measurable terms (reflective of course level) what students should be able to do when they have completed this course)

17. Course Content Outline:

1. Introduction to nanotechnology, nanoengineering and nanomaterials (1.5 week)
2. Solid phase processing into bulk materials (1 week)
3. Overview of liquid phase processing and the dispersion challenge (1 week)
4. Characterization of nanomaterial dispersions/melts and macroscale assemblies (1 week)
5. Nanomaterial dispersion: colloid science approach (2 weeks)
6. Liquid crystalline science and nanomaterials (1.5 weeks)
7. Overview of polymer nanocomposites and polymer Processing (1 week)
8. Structural, functional and active polymer nanocomposites (3 weeks)
9. Modeling of polymer nanocomposites (0.5 weeks)
10. Special topics and class presentations (1.5 weeks)
11. Tests (1 week)

(Provide a comprehensive, week-by-week breakdown of course content, including assignment due dates)
18. Assignments / Projects:
The faculty teaching the course will assign appropriate homework problems from the above topics, as well as give quizzes as necessary to reinforce concepts and assure retention. There will be three one-hour exams and a final exam. The course requires project reports and presentations.

(List all quizzes, projects, reports, activities and other components of the course grade -- including a brief description of each assignment that clarifies its contribution to the course's learning objectives)

19. Rubric and Grading Scale:

<table>
<thead>
<tr>
<th>Distribution of grade:</th>
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<tbody>
<tr>
<td>10% Class participation (discussion of reading assignments)</td>
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<tr>
<td>15% Written critical reviews of assigned papers</td>
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<td>15% Homework</td>
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<td>30% Project (20% paper, 10% presentation)</td>
</tr>
<tr>
<td>10% Final</td>
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(See Attachment 1 for a discussion of grading scale)

(List all components of the course grade -- including attendance and/or participation if relevant -- with point totals for each; indicate point totals and ranges or percentages for grading scale; for S/U grading, detail performance expectations for a passing grade)

20. Justification for Graduate Credit: N/A

(Include a brief statement explaining how the course meets graduate educational standards (i.e.: rigorous standards for evaluation, development of critical thinking and analytical skills, etc.))

(Included below are standard statements regarding course policies. If necessary, a statement may be altered to reflect the academic policies of individual faculty members and/or the academic unit or department, provided that there is no conflict with the Tiger Cub, Faculty Handbook, or any existing university policy.)

POLICY STATEMENTS

Attendance: Although attendance is not required, students are expected to attend all classes, and will be held responsible for any content covered in the event of an absence.

Excused Absences: Students are granted excused absences from class for the following reasons: illness of the student or serious illness of a member of the student's immediate family, the death of a member of the student's immediate family, trips for student organizations sponsored by an academic unit, trips for university classes, trips for participation in intercollegiate athletic events, subpoenas for a court appearance, and religious holidays. Students who wish to have an excused absence from class for any other reason must contact the instructor in advance of the absence to request permission. The instructor will weigh the merits of the request, and render a decision. When feasible, the student must notify the instructor prior to the occurrence of any excused absences, but in no case shall such notification occur more than one week after the absence. Appropriate documentation for all excused absences is required. Please see the Tiger Cub for more information on excused absences.

Make-Up Policy: Arrangement to make up a missed major examination (e.g., hourly exams, mid-term exams) due to properly authorized excused absences must be initiated by the student within one week of the end of the period of the excused absence(s). Except in unusual circumstances, such as the continued absence of the student or the absence of university holidays, a make-up exam will take place within two weeks of the date that the student initiates arrangements for it. Except in extraordinary circumstances, no make-up exams will be arranged during the last three days before the final exam period begins.

Academic Honesty Policy: All portions of the Auburn University student academic honesty code (Title XVII) found in the Tiger Cub will apply to university courses. All academic honesty violations or alleged violations of the SGA Code of Laws will be reported to the Office of the Provost, which will then refer the case to the Academic Honesty Committee.

Disability Accommodations: Students who need special accommodations in class, as provided for by the Americans With Disabilities Act, should arrange for a confidential meeting with the instructor during office hours in the first week of classes (or as soon as possible if accommodations are needed immediately). The student must bring a copy of their Accommodation Letter and an Instructor Verification Form to the meeting. If the student does not have these forms, they should make an appointment with the Program for Students with Disabilities, 1298 Haley Center, 844-2096 (V/TT).
Proposal Form For Addition And Revision Of Courses

1. Proposing College / School: Samuel Ginn College of Engineering
   Department: Chemical Engineering

2. Course Prefix and Number: CHEN 6660/6666

3. Effective Term: Fall 2010

4. Course Title: Macroscale Assembly & Applications of Nanomaterials
   Abbreviated Title (30 characters or less): Macro Assembly & Apps Nanomtrls

5. Requested Action:
   - Renumber a Course
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6. Course Credit:
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7. Grading Type:
   - Regular (ABCDF)
   - Satisfactory/Unsatisfactory (S/U)
   - Audit

8. Prerequisites/Corequisites:
   Use “P” to indicate a prerequisite, “C:” to indicate a corequisite, and “P/C:” to indicate a prerequisite with concurrency.
   P - (Graduate Program in Engineering or Science with Instructor Approval)

9. Restrictions: List specific restriction in space above.
   - College
   - Major
   - Standing
   - Degree

10. Course Description: (20 Words or Less: exactly as it should appear in the Bulletin)
    Production of macroscopic assemblies and structures from nanomaterials. Processing and applications of inorganic, organic, biological and hybrid nanomaterials.

11. May Count Either CHEN6660 or CHEN6666
    (Indicate if this particular course cannot be counted for credit in addition to another)
    Program Type: (e.g.: minor, major, etc.) Program Title: (e.g.: MS in Chemistry, Performance Option, Minor in Art) Requirement or Elective? (required or optional?)
    Major MS/PhD in Chemical Engineering Elective

12. Affected Program(s):
    (Respond “N/A” if not included in any program; attach memorandum if more space is required)

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15. Resources: No additional resources are required. The course has been offered several times as a Special Topic course. Has previously been offered as a Distance Education course.

(Indicate whether existing resources such as library materials, classroom/laboratory space, and faculty appointments are adequate to support the proposed addition/revision; if additional resources are required, indicate how such needs will be met, referencing the appropriate level of authorization -- i.e.: Dean -- where necessary; if no additional resources or shifting of resources will be necessary, respond "Not Applicable")

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(See Attachment 1 for a discussion of grading scale)

20. Justification for Graduate Credit:

JUSTIFICATION FOR GRADUATE CREDIT

Item 16 (Student Learning Outcomes) reflects the general learning expectations required at the 5000-level. Graduate students expectations are higher but cannot be easily expressed in citing this list. Rather, the following justification is provided: (1) Homework: Some problems are for graduate students only (as discussed and listed in the course syllabus), (2) Written critical reviews: Graduate student written critical reviews (~7 per semester) of assigned readings and/or presentations will be at least 2 pages long whereas undergraduate reviews will be at least 1 page, (3) Project reports: Graduate student project reports will be at least 25 pages with more than 10 references where the references are comprised of at least 1 patent and at least 5 science/engineering peer reviewed journal articles. Undergraduate student project reports will be at least 15 pages long with > 7 references at least 1 patent and 2 science/engineering peer reviewed journal articles, (4) Higher order thinking: Undergraduate students need to comprehend and demonstrate the ability to conduct basic analysis of the literature and mass media representations of topics covered in class. Graduate students are expected to synthesize information and evaluate the field in order to formulate their own thoughts, particularly with regard to their project. This is also true for critical reviews particularly those on controversial topics (i.e., is it possible for Drexler’s vision of nanobots to become a reality and what would the societal implications be?).

JUSTIFICATION FOR DISTANCE EDUCATION OFFERING

Prerequisites: Admission to AU Distance Education Program in Engineering or Science and Instructor Approval.
Course Content: Identical to on-campus version. Distance Education format is easily adapted from the on-campus version. Course has already been offered successfully as Distance Education Special Topic course.
Evaluation: Existing College of Engineering policies regarding administration and transmission of evaluation items will be observed including notification of results to student.
Note that, arrangements for students in the distance education class will be made on a case by case basis to replace class participation with online discussions, telephone calls, or additional written communication. Distance education students will be required to contact the instructor within one week of the start of the semester to establish clear expectations on timing and completion.
Available of resources: Online literature sources are equally available to on-campus as well as distance education students.

(Include a brief statement explaining how the course meets graduate educational standards (i.e.: rigorous standards for evaluation, development of critical thinking and analytical skills, etc.))

(Included below are standard statements regarding course policies. If necessary, a statement may be altered to reflect the academic policies of individual faculty members and/or the academic unit or department, provided that there is no conflict with the Tiger Cub, Faculty Handbook, or any existing university policy.)

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Appendix 1

Department of Chemical Engineering
Policy Regarding Grading of Undergraduate Classes

Course grades are established by the individual faculty teaching the course consistent with student performance and published university guidelines.

The following summarizes the criteria published in the University Bulletin (parenthetical information provided for clarity):

A: Superior
B: Good (not Superior)
C: Acceptable (not Good)
D: Passing (not Acceptable and not Failing)
F: Failing (not Passing)

The following characteristics of student performance are the general grade benchmarks used by the majority of the departmental faculty:

**Characteristics of Grade Benchmarks**

A - Student clearly demonstrates an in-depth technical understanding of the concepts. Able to offer different technical viewpoints and solutions to a problem. Demonstrates the ability to apply the concepts creatively. Consistently carries problems to a final and justified solution. Demonstrates technical leadership in the subject.

B - Student demonstrates a technical understanding sufficient for solving the majority of problems. Able to propose at least one technical solution or viewpoint to a problem. Consistently carries problems to a satisfactory solution. Can explain and justify a conclusion or approach most of the time.

C - Student demonstrates a technical understanding sufficient for solving straightforward problems but may have trouble with more complex variations or situations. Carries problems through to an adequate solution most of the time. Able to explain and justify conclusions or approaches for many cases but with uncertainty.

D - Student's ability to apply the concepts even to straight-forward problems is marginal. Carries problems through to an adequate solution only sporadically. The ability to explain or justify conclusions is weak and sporadic. There would be a question with regard to the ability to work in the area in an industrial setting.
F - Student's ability to apply the concepts to problems is seriously in question. The ability to work in the area in an industrial setting is undemonstrated.

Revision 12/9/2009